A family of highly advanced pressure sensing systems exemplifies the benefit potential of aerospace technology transfer

Spinoff from Wind Tunnel Technology

Last spring, Pressure Systems Incorporated (PSI) dedicated a new, million-dollar plant and headquarters in Hampton, Virginia, a major milestone in the company's short but active history. PSI began life—in 1977—in a single room of the home of its president and founder, former NASA instrument design engineer Douglas B. Juanarena. A year later, the firm started deliveries of its initial product and in 1979 expanded into a 5,000 square foot facility in Hampton. The new plant offers three times as much floor space and from all indications PSI will need every inch of it; in the short span of eight years, the company has become one of the world's leading suppliers of electronic pressure scanning equipment.

PSI is an aerospace spinoff company whose product line originated in work at Langley Research Center in the early 1970s. Langley was looking for a way to obtain better accuracy and higher data rates in measuring airflow pressures at a great many points in a wind tunnel model. Mechanical systems then in use had a maximum capability of 10 measurements a second. That required long and repetitive tunnel runs to accomplish the hundreds of measurements needed in a typical test program; additionally, inaccuracies were induced because test conditions changed over the lengthy period necessary to make the measurements. There was a corollary need to cut energy costs, which were then soaring as a result of the world energy crisis. Since wind tunnels consume enormous amounts of energy, it became imperative to find means of shortening tunnel operating times without compromising data accuracy or quantity.

Langley found a solution to both problems in a new technology known as electronically scanned pressure (ESP), developed by a team that included engineers Douglas Juanarena, Thaddeus Basta Jr., George Walker and the project's chief, Chris Gross. The Langley ESP measurement system was based on miniature integrated circuit pressure-sensing transducers that communicated pressure information to a minicomputer; these sensors were capable of being calibrated while in use, an innovation that greatly improved accuracy. High data

Above, a Space Shuttle Orbiter model is undergoing wind tunnel test at Langley Research Center. Tests like this require hundreds of measurements of pressure distributions on the model. Langley's problem, in the early 1970s, was that mechanical pressure-sensing methods provided only five to 10 measurements a second, necessitating long and expensive test runs. The answer was a new Langley-developed technology that allowed extremely high measurement rates; since translated into a commercial product line marketed by Pressure Systems Incorporated (PSI), it is known as electronically scanned pressure.

rate was achieved by using one transducer for each pressure port in a wind tunnel, a development that would have been impractical with mechanical systems because of size and cost considerations. Inherent errors in the transducers were automatically corrected by a microprocessor. The basic system, developed over several years, was a module with 48 transducers—or channels—capable of making 1,000 measurements a second, a hundredfold improvement. In addition, the module was small in size, relatively low in cost, highly accurate and more reliable than predecessor systems, in all a major advance in pressure-sensing technology.

In 1978, Douglas Juanarena obtained a license to manufacture and market products based on the NASA-patented technology, resigned his Langley position and founded PSI. He was subsequently joined by the other members of the ESP development team. Chris Gross is now PSI's executive vice president, George Walker is vice president for production and Thaddeus Basta is chief systems engineer.

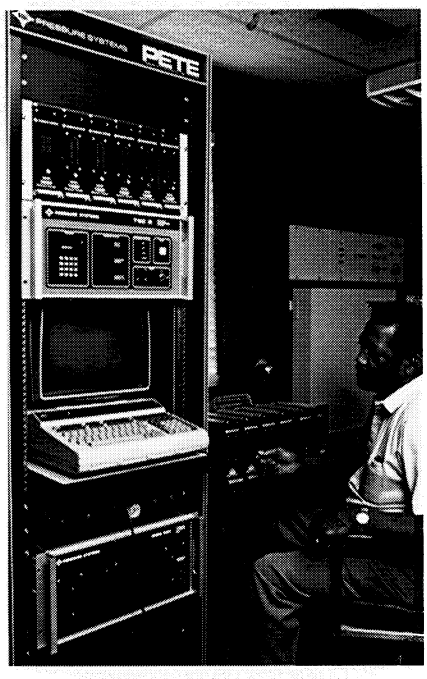
PSI continued to develop the technology and now produces ESP modules and accessories in 16, 32 and 48 channel configurations, with data rates up to 20,000 measurements a second, for use in wind tunnels and engine test stands, and for in-flight pressure measurements in aircraft. Customers include U.S. and foreign government research centers and major aerospace companies, who operate their own wind tunnels and engine test facilities. PSI found a secondary market in the auto industry. Automakers, particularly European firms, are becoming increasingly interested in reducing aerodynamic drag and they are using pressure sensors in wind tunnel and test track research. Users of PSI equipment include Mercedes-Benz, Porsche and Volkswagen.

Looking to the broader potential of ESP technology, PSI developed an industrial pressure scanner for automation of industrial processes where there is need for making multiple pressure measurements quickly and with high accuracy. Capable of making up to 2,000 measurements a second, the company's DPT 6400 module has 64 channels but the system can be expanded to 256 channels by addition of "slave" units. Relatively new, the DPT 6400 has already found a place in the industrial market with applications in a number of process plants and refineries. For example, Eastman Kodak Company, Rochester, New York, uses the system to monitor pressures in an emulsion process wherein even distribution of pressure is important while applying coating to film; Formica Corporation, Evendale, Ohio uses ESP modules to calculate the flow rate of fiber blown through ducts; Huntington Alloy, Huntington, West Virginia, monitoring fuel consumption in natural gas furnaces, employs PSI equipment to determine the gas flow rate.

PSI's product line now embraces 10 basic pressure measurement systems plus a variety of ancillary instruments and accessories. Sales reached the million-dollar level by 1981 and in 1985 they are expected to top $2.5 million. Company officials forecast substantial growth over the next five years, particularly through the DPT 6400, a valuable aid to automating industrial process plants.

The entire PSI product line stemmed from the original ESP work at Langley, a fact that points up the economic potential of spinoff. As happens frequently, a technology transfer resulted in establishment of a thriving new company, with attendant benefit to the nation's Gross National Product and to job creation. Spinoffs whose benefits are valued in the millions of dollars—such as PSI—are not unusual. In other cases, spinoffs generate only moderate economic gain but provide significant public benefit in other ways, ranging from simple conveniences to important developments in medical and industrial technology.

For the past 23 years, under its Technology Utilization Program, NASA has been actively engaged in encouraging the secondary application of aerospace technology. During that time, literally thousands of aerospace originated innovations have found their way into everyday use. Collectively, these spinoffs represent a substantial return on the aerospace research investment in terms of economic gain, improved industrial efficiency and productivity, lifestyle enhancement and solutions to problems of public concern.



Above, a technician is monitoring a PSI pressure scanner. Shown below is the company's latest system, the DPT 6400, designed to permit up to 2,000 measurements a second in industrial process applications.